We claim:

1. A sensor adapted to sense the angular position of a rotatable shaft, the sensor comprising:

an annular magnet connected for rotation coaxial with the shaft; the annular magnet having been magnetized according a method comprising the step of temporarily inserting an iron core through its inside diameter;

a first stationary magnetic field sensor element positioned to sense the change in magnetic flux as the magnet rotates and adapted to provide an output signal proportional to the magnetic flux sensed; and

an amplifier circuit operable to amplify the output signal from the sensor element and to provide an output signal having a magnitude proportional to the angular position of the shaft.

2. The sensor as defined in claim 1 further comprising a magnetic-shield housing, and in which said shaft extends through the housing and the annular magnet and sensor element are located in the housing around the shaft.

3. The sensor as defined in claim 1 further comprising a second magnetic field sensor element spaced 180 degrees from said first sensor element, and in which the annular magnet is magnetized with two radial poles spaced 180 degrees apart.

4. The sensor as defined in claim 3 in which said method includes the step of sizing the magnet for enhanced linearity of flux density over a range of approximately +/- 60 degrees of rotation from a neutral position equi-distance between said poles.

5. The sensor as defined in claim 4 in which the amplifier circuit provides a differential output voltage that varies linearly with shaft rotation of +/- 60 degrees from said neutral position.

6. The sensor as defined in claim 5 in which the differential output voltages are referenced to a desired voltage level.

7. The sensor as defined in claim 5 in which the amplifier circuit includes an input network resistor to produce an amplified and noise-filtered output signal proportional to shaft angle for +/- 60-degrees of rotation from said neutral position.

8. The sensor as defined in claim 5 in which the amplifier circuit includes an input network capacitor to produce an amplified and noise-filtered output signal proportional to the shaft rate of rotation for +/- 60 degrees of rotation from said neutral position.

9. A sensor adapted to sense the angular position of a rotatable shaft, the sensor comprising:

a bipolar annular magnet connected for rotation coaxial with the shaft; the annular magnet having its poles located 180 degrees apart and having been magnetized according a method comprising the step of temporarily inserting an iron core through its inside diameter to obtain enhanced linearity of flux density over a range of approximately +/- 60 degrees of rotation from a neutral position equi-distance between the poles;

three pairs of magnetic field sensor elements positioned to sense the change in magnetic flux as the magnet rotates; the pairs of sensor elements being operatively spaced 120 degrees apart and adapted to provide differential signals that are 120 degrees out of phase with each other as the magnet rotates; said differential signals comprising linear segments having magnitudes proportional to the angular position of the shaft for 120 degree increments of shaft rotation;

a commutation circuit receiving said differential signals and providing logic signals indicative of said linear segments; and

an output block receiving said logic signals and said linear segments, and adapted to provide an output signal therefrom, the output signal having a magnitude proportional to one of (i) the angular position and (ii) the rate of rotation of the shaft.

10. The sensor as defined in claim 9 in which the commutation circuit is operative to provide said logic signals based on the signal polarity of said differential signals, and in which said output block is operative to select said linear segments based on said logic signals and to provide said output signal comprising said selected linear segments.

11. The sensor as defined in claim 10 in which the commutation circuit comprises comparators operative to provide said logic signals in the form of high-low signals from the signal polarity of said differential signals.

12. The sensor as defined in claim 11 in which the high-low logic signals are manipulated by four NOR gates prior to said output block, two of said NOR gates being configured to function as logic inverters.

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13. The sensor as defined in claim 12 in which said output block includes a multiplexer receiving said high-low logic signals from said NOR gates, said multiplexer being operative to selectively switch said linear segments to a common port in response to said high-low logic signals to establish said output signal comprised of said switched linear segments.

14. The sensor as defined in claim 9 further comprising an amplifier circuit receiving said differential signals and supplying said differential signals to said commutation circuit in the form of amplified differential signals, the amplifier circuit including an input network capacitor adapted to produce said amplified signals proportional to the shaft rate of rotation through 360 degrees of rotation.

15. The sensor as defined in claim 14 in which the input network further comprises input resistors biased to provide equal amplified linear segments at intermediate switch points therebetween and an output voltage which is proportional to shaft rotational angle for a full 360-degree rotation.

16. The sensor as defined in claim 11 in which said output block includes a microcomputer operative to establish signal switching points in response to said logic signals, and to provide said output signal comprised of said linear segments merged at said signal switching points.

17. The sensor as defined in claim 16 in which the microcomputer establishes said signal-switching points in response to shaft rotation.

18. The sensor as defined in claim 16 in which the microcomputer stores the voltage difference between said switch points and provides gain correction factors to each linear segment.

19. The sensor as defined in claim 16 in which the microprocessor numerical biases said linear segments to mathematically match the segments at said switch points.

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~~20. The sensor as defined in claim 16 in which the microprocessor is operative to calculate the rate of change of position and provide said output signal proportional thereto.~~

21. A sensor adapted to sense the angular position of a rotatable shaft, the sensor comprising:

a bipolar annular magnet connected for rotation coaxial with the shaft; the annular magnet having its poles located 180 degrees apart and having been magnetized according a method comprising the step of temporarily inserting an iron core through its inside diameter to obtain enhanced linearity of flux density over a range of approximately +/- 60 degrees of rotation from a neutral position equi-distance between the poles;

three pairs of magnetic field sensor elements positioned to sense the change in magnetic flux as the magnet rotates; the pairs of sensor elements being operatively spaced 120 degrees apart and adapted to provide differential signals that are 120 degrees out of phase with each other as the magnet rotates; said differential signals comprising linear segments having magnitudes proportional to the angular position of the shaft for 120 degree increments of shaft rotation;

an amplifier circuit operable to amplify the differential signals; and

a microprocessor-based circuit receiving said amplified differential signals and operative to provide an output signal proportional to one of shaft angular position and shaft speed through 360 degrees of shaft rotation.